

Remarks

Please note that, as there are now four independent claims, a check in the amount of \$43.00 is enclosed for the fourth independent claim.

The above amendments to the previously existing claims are offered for two purposes. First, the amendments to claims 1 and 12 address the Examiner's objections, correcting the inadvertent omission of a step (c). Second, the amendments to claims 1 and 12 transfer the salient element of claims 14 and 15, the step of activating the catalyst, from those claims to the original independent claims. Activation of applicants' catalyst assures that no more than a negligible amount of water will be manufactured when the CO conversion process is conducted in the presence of a significant amount of hydrogen, as required by the claims under scrutiny.

35USC103(a) has been applied to all of the claims, the Examiner citing each of Falke et al 5,112,787 and Falke et al 5,068,217 separately in view of Haruta et al 4,839,327. On page 3 of the Official Action, Examiner points out some of the features of the Falke et al references, but does not mention that the '787 patent is limited to a supported catalyst and the '217 patent is characterized as on a carrier. This is significant not only because applicants' catalyst need not be on a support or in a carrier, but also because the Falke et al '787 "solids" must be further processed according to either step B1 or B2 – see column 7, lines 10-12 and column 5, lines 15-26. It should be noted also that applicants do not merely add a base to the gold/iron solution, as described in Falke et al '787 column 5 line 55, but combine the solutions gradually in order to assure that the pH remains between 7 and 9 throughout the precipitation, as required by both claims 1 and 12. The Falke et al '217 patent offers nothing additionally relevant to applicants' approach; in fact the authors intend for the active material to be formed on the surface on the carrier material, and the base can even be contacted with the carrier material after impregnation – column 5, lines 18-27.

In his recitation of the elements found in the Falke et al and Haruta patents, Examiner quite correctly does not say anything about the presence of a large amount of hydrogen in the gases treated by any of the references. An important feature of applicants' invention is the presence of at least 65% hydrogen in the CO-containing gas mixture treated by the catalyst. This high percentage of hydrogen is explicitly recited in all the claims and is absent in the references. Accordingly, the processes are different – that is, because applicants deal with a feed gas radically different from the

references, different problems are presented. Applicants' problem is to oxidize the CO without making a significant amount of water while doing so – see the first paragraph of applicants' "Summary of the Invention." Applicants have achieved this objective while avoiding the need for a support (although one may still want to use one in some circumstances). Clearly, one skilled in the art who is working with a gas mixture containing at least 65% hydrogen must be concerned about the oxidation of the hydrogen concurrently with oxidation of the carbon monoxide. The oxidation of hydrogen to water not only could drastically reduce the efficiency of the oxidation step, but also causes physical problems with the process because the presence of significant amounts of water causes restrictions in the flow of the gas through the catalyst site, resulting in high pressure drops. The problem is most acute when working with commercially common gas mixtures having a high ratio of hydrogen to carbon monoxide – see lines 12-15 of page 1 of the present specification. One does not need or want to make water. Efficiency demands that essentially only the CO is oxidized, if possible. An efficient catalyst that will oxidize the CO without acting on the hydrogen will obviate any possible need for separating the gases.

As indicated above, none of the three reference patents addresses the oxidation of CO in a mixture of gases containing at least 65% hydrogen. Indeed, the possible presence of hydrogen in a treated gas is not mentioned at all in either of the Falke et al patents. The "Background" of both Falke et al patents discusses only CO from sources unlikely to contain hydrogen. Haruta et al '327 is directed mainly to the manufacture of catalysts containing gold, for use in various types of catalysts including reducing catalysts as well as oxidizing (see column 1, lines 8-14). Significantly, in discussing proposed oxidizing uses for their invention, Haruta et al describe hydrogen as a fuel, and include it as such in the same sentence as carbon monoxide, in column 7, lines 20-33. The problem of selectively oxidizing CO in the presence of at least 65% hydrogen is not addressed or even acknowledged; indeed, it is important to recognize that Haruta wants to oxidize hydrogen, and applicants do not; hydrogen is in the feed gas of applicants' claims, but either avoided as a component of the feed gas in the references, or deliberately oxidized, providing results quite different from applicants'.

The Examiner's attention is now directed to new claims 16 and 17, which are similar to claims 1 and 12 but include especially conclusory elements requiring that the hydrogen present in the feed gas is substantially unoxidized while the desired oxidation of the CO takes place. Note also that claim 17

requires passing the gas through the catalyst bed for at least 24 hours, after which the hydrogen is passed through the bed substantially unaffected.

These new claims spell out the advantages of the present invention while clearly differentiating from the references. There are no instances in the references of high-hydrogen feed gases; the references avoid hydrogen because the authors know it is normally readily oxidized and that oxidation of the hydrogen is highly undesirable. The amended and new claims are not only emphatic about the composition of the feed gas, but also the results obtained. The references address different problems and describe different processes. No combination of the references can lead to applicants' claimed invention without using applicants' disclosure as a guide with respect at least to the ability to avoid oxidizing hydrogen, and even then it should be remembered that both of the Falke et al references appear to require supports for their catalysts.

In view of the above arguments and amendments, the rejections should be withdrawn.

Status of the claims after the above amendments is shown in the appended sheets.

Respectfully submitted,

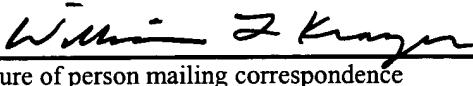


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1. (Currently Amended) Method of oxidizing CO in a mixture of gases including oxygen and at least 65% hydrogen comprising passing said mixture of gases through a catalyst bed comprising a catalyst made by (a) preparing an aqueous iron/gold solution comprising an iron source and a gold source (b) gradually combining said iron/gold solution with an aqueous solution of an alkali metal base to maintain a pH of 7 to 9 in the combined solution as the solutions are combined, thereby producing solids in said combined solution ~~(d) (c)~~ separating said solids from said combined solution ~~(e) (d)~~ (e) washing said solids, ~~(f) (e)~~ (f) drying said solids, ~~(g) (f)~~ (g) grinding said solids to a size range of 0.85mm to 4.25mm, ~~and (h) (g)~~ calcining said solids, ~~and (h) activating said solids.~~
2. (Original) Method of claim 1 wherein said gold source comprises $\text{HAuCl}_4 \cdot 3\text{H}_2\text{O}$.
3. (Original) Method of claim 1 wherein said iron source comprises $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$.
4. (Original) Method of claim 1 wherein step (b) is conducted at a temperature of 50°C to 90°C.
5. (Original) Method of claim 1 wherein said pH is maintained at 7.5-8.5.
6. (Original) Method of claim 1 wherein said pH is maintained at 7.8-8.2.
7. (Original) Method of claim 1 wherein said gold is present in said catalyst as 0.25% to 10% by weight of said iron oxide.
8. (Original) Method of claim 7 wherein said gold is present in said catalyst as 1% to 3% by weight of said iron oxide.
9. (Original) Method of claim 1 wherein said alkali metal base is sodium carbonate.
10. (Original) Method of claim 1 wherein said mixture of gases comprises 200ppm to 20,000ppm carbon monoxide and at least 10% carbon dioxide.

11. (Original) Method of claim 1 wherein said catalyst has a size range of 1mm to 1.4mm.
12. (Currently Amended) Method of oxidizing CO in a mixture of gases including oxygen and at least 65% hydrogen and wherein said CO is present in an amount from 200ppm to 20,000ppm, said gas also containing methane, comprising passing said mixture of gases through a catalyst bed comprising a particulate catalyst made by (a) preparing an aqueous iron/gold solution comprising an iron source and a gold source (b) gradually combining said iron/gold solution with an aqueous solution of an alkali metal base to maintain a pH of 7 to 9 in the combined solution as the solutions are combined, thereby producing solids in said combined solution ~~(d)~~ ~~(c)~~ separating said solids from said combined solution ~~(e)~~ ~~(d)~~ washing said solids, ~~(f)~~ ~~(e)~~ drying said solids, ~~(g)~~ ~~(f)~~ grinding said solids to a size range of 0.85mm to 4.25mm, and (h) (g) calcining said solids to form a catalyst, and (h) activating said catalyst, wherein the gold in said catalyst is present in an amount from 0.25% to 10% by weight of the iron in said catalyst.
13. (Original) Method of claim 12 wherein said gold is present as 1-3% of the weight of said iron.
14. (Canceled)
15. (Canceled)
16. (New) Method of oxidizing CO in a mixture of gases including oxygen and at least 65% hydrogen comprising passing said mixture of gases through a catalyst bed comprising a catalyst made by (a) preparing an aqueous iron/gold solution comprising an iron source and a gold source (b) gradually combining said iron/gold solution with an aqueous solution of an alkali metal base to maintain a pH of 7 to 9 in the combined solution as the solutions are combined, thereby producing solids in said combined solution (c) separating said solids from said combined solution (d) washing said solids, (e) drying said solids, (f) grinding said solids to a size range of 0.85mm to 4.25mm, (g) calcining said solids, and (h) activating said solids, whereby said CO is oxidized while said hydrogen passing through said catalyst bed is substantially unoxidized.

17. (New) Method of oxidizing CO in a mixture of gases including oxygen and at least 65% hydrogen and wherein said CO is present in an amount from 200ppm to 20,000ppm, said gas also containing methane, comprising, for a period of at least 24 hours, passing said mixture of gases through a catalyst bed comprising a particulate catalyst made by (a) preparing an aqueous iron/gold solution comprising an iron source and a gold source (b) gradually combining said iron/gold solution with an aqueous solution of an alkali metal base to maintain a pH of 7 to 9 in the combined solution as the solutions are combined, thereby producing solids in said combined solution (c) separating said solids from said combined solution (d) washing said solids, (e) drying said solids, (f) grinding said solids to a size range of 0.85mm to 4.25mm, (g) calcining said solids to form a catalyst, and (h) activating said catalyst, wherein the gold in said catalyst is present in an amount from 0.25% to 10% by weight of the iron in said catalyst, and whereby, after said 24 hours, said hydrogen passing through said catalyst bed is substantially unoxidized while said CO passing through said bed is substantially oxidized.